

A New Hippolytid Shrimp of the Genus *Lebbeus* White, 1847 from the Sagami-Nada Sea, Central Japan, with Further Records of Two Little-Known Species (Crustacea: Decapoda: Caridea)

Tomoyuki Komai¹ and Masatsune Takeda²

¹ Natural History Museum and Institute, Chiba, 955–2 Aobacho, Chuo-ku, Chiba, 260–8682 Japan

e-mail: komai@chiba-muse.or.jp

² Department of Zoology, National Science Museum, 3–23–1 Hyakunincho,

Shinjuku-ku, Tokyo, 169–0073 Japan

e-mail: takeda@kahaku.go.jp

Abstract A new species of the hippolytid shrimp genus *Lebbeus* White, 1847, *L. nudirostris*, is described from one female specimen collected from the Sagami-Nada Sea, central Japan, at a depth of 250 m. A comparison with congeneric species is made. Supplemental information is provided for two recently described species, *Lebbeus spongiaris* Komai, 2001 and *L. tosaensis* Hanamura et Abe, 2003, based on the material also from the Sagami-Nada Sea.

Key words: Crustacea, Decapoda, Caridea, Hippolytidae, *Lebbeus*, new species, Sagami-Nada Sea, Japan.

The genus *Lebbeus* White, 1847 is the most diversified group within the family Hippolytidae, with about 40 species currently recognized as valid (Hayashi, 1992; Chace, 1997; Hayashi & Okuno, 1997; Fransen, 1997; Crosnier, 1999; Komai, 2001; Hanamura & Abe, 2003). Many species are considered to be free living, but some are associated with other invertebrates such as sponges, sea anemones and crinoids. Association with hydrothermalism is also known for two species (Kikuchi & Ohta, 1995; Desbruyères & Segonzac, 1997). Furthermore, the genus shows a remarkable cosmopolitan distribution extending from cold to tropical waters, including the Arctic and Antarctic, although geographical ranges of many species appear restricted to narrow area. The genus can be a good example for study of historical biogeography. However, it is apparent that the taxonomy of *Lebbeus* still needs further study as mentioned by some contributors. At present, 22 species are known from East Asian waters, but there is little doubt that future

survey will yield more species from the region.

Since the year 2000, the National Science Museum, Tokyo, has carried out an ongoing survey of the deep-water benthic fauna of the Sagami-Nada Sea and adjacent area, central Japan. Material was collected by commercial trap for scampi, gill net, and dredge (using the RB *Rinkai-Maru* of the University of Tokyo and the TRV *Shin'yo-Maru* of the Tokyo University of Marine Science and Technology) and resulted in a vast collection of crustacean specimens. During sorting of this material, three species of *Lebbeus*, reported in this paper, were identified. At the time of the sorting, two of the three were undescribed. Given that only one specimen existed for each two undescribed species, the preparation of a manuscript was delayed awaiting the possibility of collecting additional material. However, various collecting efforts during the field survey in the sea in question failed to produce any additional material. We now describe a new species named *L. nudirostris*, and compare it with *L. miyakei*

Hayashi, 1992 from Japan, *L. profundus* (Rathbun, 1906) from Hawaii and *L. saldanhae* (Barnard, 1947) from South Africa. The second species, undescribed at the time of sorting, is now referred to *L. tosaensis* Hanamura et Abe, 2003, recently described from Tosa Bay, south-western Japan. The third species is *L. spongiaris* Komai, 2001, recently described from the Izu Islands, off central Japan. Supplemental notes are provided for the latter two species.

The specimens used in this study are deposited in the Showa Memorial Institute, National Science Museum, Tokyo (NSMT). The postorbital carapace length (CL) is used as a standard measurement indicating the size of specimens. Mouthparts of the new species were not dissected, as only the holotype was available for study.

Taxonomic Accounts

Family Hippolytidae

Genus *Lebbeus* White, 1847

Lebbeus nudirostris sp. nov.

[New Japanese name: Sagami-ibara-moebi]

(Figs. 1A, 2, 3)

Type material. West of Taibusa-misaki, Boso Peninsula, 35°04.68'N, 139°45.32'E, 250 m, FB *Ido-Inkyo-Maru* No. 3, trap for scampi, holotype, female (CL 6.3 mm), NSMT-Cr S004, 8 March 2002, coll. H. Namikawa & Y. Imahara.

Description. Body (Fig. 1A) moderately robust for genus; integument naked, glabrous, not particularly hard.

Rostrum (Fig. 2A, B) straight, directed forward, strongly compressed laterally, falling short of distal margin of first segment of antennular peduncle, 0.46 times of carapace length; both dorsal and ventral margins unarmed; lateral surface with short, but clearly delineated ridge extending from base of supraorbital spine. Carapace (Figs. 1A, 2A–C) with moderately high, blunt postrostral median carina extending nearly to posterodorsal margin of carapace and sloping toward rostral base, bearing 3 relatively large spines, of which posteriormost spine is arising at

0.33 of carapace length; orbital region weakly depressed; supraorbital spine relatively large, arising anteriorly to level of posterior margin of orbit; orbital margin generally concave, but with U-shaped notch inferior to base of supraorbital spine; suborbital lobe well-developed, subtriangular with subacute apex, slightly overreaching antennal spine; antennal spine small; pterygostomian spine also small, slightly exceeding antennal spine; anterolateral margin between antennal and branchiostegal spines sinuous with shallow excavation just inferior of antennal spine.

Abdomen (Figs. 1A, 2D) with all somites dorsally rounded. Second somite with transverse groove on tergum shallow, not abruptly delimited. Posterodorsal margin of third somite well produced. Pleura of anterior 4 somites broadly rounded, fifth pleuron with moderately strong posteroventral tooth. Sixth somite about 1.67 times as long as the fifth, and about 1.40 times as long as height, bearing small posteroventral tooth; posterolateral process terminating in tiny spine. Telson (Fig. 2E) 1.93 times as long as sixth somite, 2.84 times longer than anterior width, lateral margins parallel in anterior 0.35, and then tapering posteriorly to convex posterior margin, with 5 dorsolateral spines on either side; posterior margin (Fig. 2F) with 2 pairs of lateral spines (mesial pair longest) and 8 short setulose spines between 2 lateral pairs.

Eye (Figs. 1A, 2A, C) subpyriform with cornea distinctly wider than eye-stalk; ocellus absent; maximum diameter of cornea about 0.20 of carapace length.

Antennular peduncle (Fig. 2A, C) reaching 0.75 of antennal scale. First segment longer than distal 2 segments combined, falling short of mid-length of antennal scale, unarmed on dorsodistal margin; stylocerite slightly overreaching distal margin of first segment, sharply pointed, mesial margin convex, not overlapping first segment; second segment about 0.60 length of first segment, with large spine at dorsolateral distal angle; third segment short, with moderately large spine on dorsodistal margin. Lateral flagellum with thickened aesthetasc-bearing portion 0.39

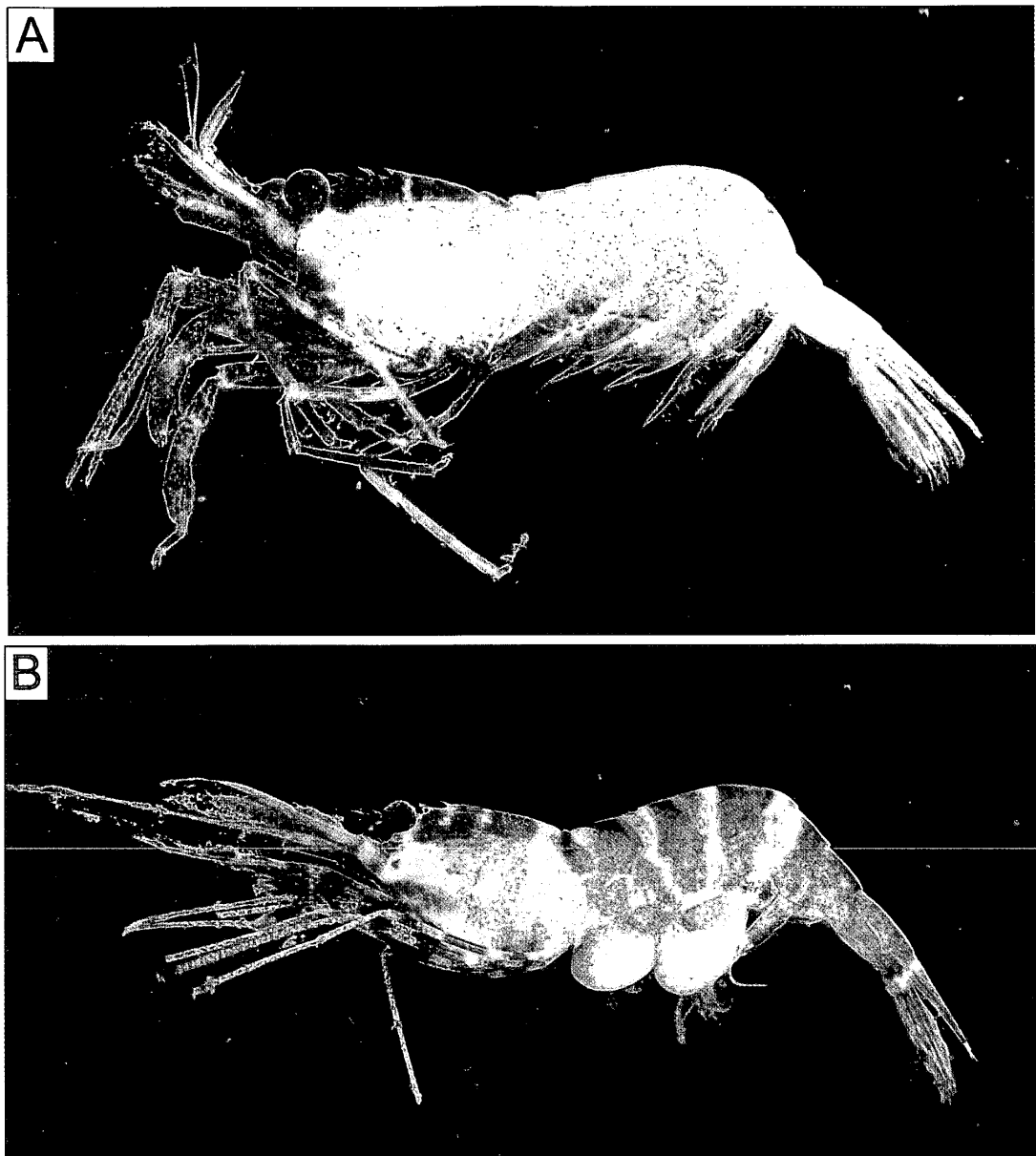


Fig. 1. A, *Lebbeus nudirostris* sp. nov., holotype female (CL 6.3 mm; NSMT-Cr S004), from Sagami-Nada Sea, entire animal in lateral view; B, *Lebbeus tosaensis* Hanamura et Abe, female from Sagami-Nada Sea (CL 7.7 mm; NSMT-Cr S335), entire animal in lateral view.

times as long as carapace in female.

Antenna (Fig. 2A, C) with basicerite bearing moderately small distolateral spine; carpocerite overreaching midlength of antennal scale. Antennal scale (Fig. 2G) 0.68 times as long as carapace and 3.20 times as long as wide; lateral margin faintly concave; distolateral tooth distinctly overreaching rounded distal margin of blade.

Mouthparts similar to those of other species (cf. Hayashi, 1992; Komai, 2001; Hanamura & Abe, 2003). Third maxilliped (Fig. 3A) relatively

long, overreaching antennal scale by 0.80 length of ultimate segment; ultimate segment 3.17 times as long as carpus (=penultimate segment), tapering distally, with short row of darkly pigmented corneous spines distally (Fig. 3B); antepenultimate segment shorter than distal 2 segments combined, with slender basally articulated spine on distolateral margin; lateral surface bluntly ridged; coxa with strap-like epipod.

Gill formula summarized in Table 1. Anterior 3 pereopods each with strap-like, hooked epipod

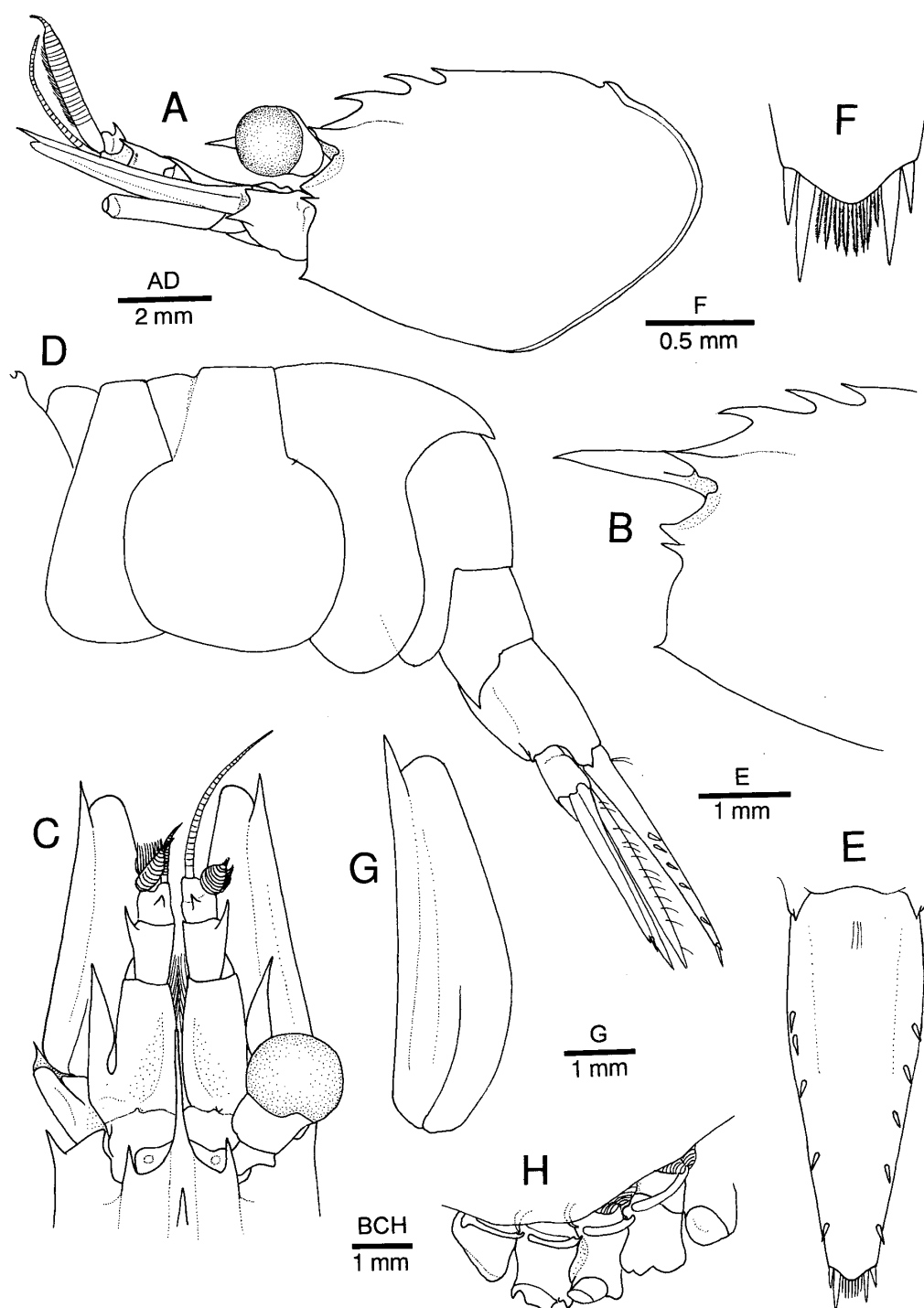


Fig. 2. *Lebbeus nudirostris* sp. nov., holotype female (NSMT-Cr S004). A, carapace and cephalic appendages, lateral view; B, anterior part of carapace, lateral view; C, anterior part of carapace and cephalic appendages, dorsal view; D, abdomen, lateral view; E, telson, dorsal view; F, posterior part of telson, dorsal view; G, left antennal scale, dorsal view (marginal setae omitted); H, coxae of third maxilliped to third pereopods, showing presence of epipods, ventrolateral view.

Table 1. *Lebbeus nudirostris* sp. nov., gill formula.

	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranch	—	—	—	+	+	+	+	+
Arthrobranch	—	—	—	—	—	—	—	—
Podobbranch	—	+	—	—	—	—	—	—
Exopod	+	+	—	—	—	—	—	—
Epipod	+	+	+	+	+	+	—	—
Setobranch	—	—	—	+	+	+	—	—

(Fig. 2H). Setobranchs present on first to third pereopods, but no setobranch on fourth pereopod corresponding to epipod on third pereopod.

First pereopod (Fig. 3C) moderately stout, overreaching distal margin of antennal scale by half length of chela; chela (Fig. 3D) 2.44 times as long as carpus, 4.44 times longer than wide; dactylus 0.56 times as long as palm, terminating in 2 darkly pigmented corneous claws; merus 2.09 times as long as carpus and 4.05 times longer than greatest width, subcylindrical, obliquely articulated to ischium, bearing short row of slender spinules on proximal 0.20 of ventral surface; dorsolateral face of merus with spinule at articulation with ischium. Second pereopod (Fig. 3E) overreaching antennal scale by length of chela and half of carpus; chela small with subcylindrical palm; dactylus 0.62 of palm length, terminating in 2 small claws; carpus 3.33 times as long as chela, divided in 7 articles; articles in following ratios from proximal to distal 1.00:0.60:2.27:0.87:1.00:0.60:1.07; ischium subequal in length to merus, with few spiniform setae subproximally. Third to fifth pereopods moderately long and slender, slightly decreasing in length posteriorly. Third pereopod (Fig. 3F) overreaching antennal scale by length of dactylus and half of propodus; dactylus (Fig. 3G) 0.24 times as long as propodus, moderately stout (3.75 times as long as height), terminating in acute, darkly pigmented unguis, armed with 5 darkly pigmented accessory spinules; propodus with row of sparse spinules on ventral margin; carpus 0.42 times as long as propodus; merus 8.84 times as long as high, armed with 1 subdistal spine on lateral surface ventrally. Fourth pereopod (Fig.

3H) overreaching antennal scale by length of dactylus; dactylus with 5 accessory spinules; merus with 2 spines on lateral surface ventrally. Fifth pereopod (Fig. 3I) not reaching distal margin of antennal scale; dactylus (Fig. 3J) with 5 accessory spinules; propodus with patch of very short setae distoventrally (Fig. 3J); merus with 1 subdistal spine.

Female pleopods typical of genus, without distinctive feature. Uropod with both rami reaching posterior margin of telson.

Coloration. Body (Fig. 1A) generally pale pink; carapace with short white transverse band on dorsal surface at about midlength. Third maxilliped and first pereopod darker pink, other pereopods nearly colorless.

Distribution. So far known only from the type locality in the Sagami-Nada Sea at a depth of 250 m.

Etymology. From the Latin *nude* (naked) and *rostrum* (rostrum), and in reference to the unarmed rostrum.

Remarks. This new species is characterized by having epipods on the anterior three pereopods, well-developed, but short rostrum not reaching distal margin of the first segment of the antennular peduncle and the rounded fourth abdominal pleuron. Among the 37 species of *Lebbeus* currently considered valid, the set of these features are shared with *L. miyakei* Hayashi, 1992 from Japan, *L. profundus* (Rathbun, 1906) from Hawaii, and *L. saldanhae* (Barnard, 1947) from South Africa (Rathbun, 1906; Hayashi, 1992; Fransen, 1997). *Lebbeus nudirostris* is readily distinguished from the latter three species by the rostrum unarmed on both dorsal and ventral margins, three relatively large median spines on the carapace of which the posteriormost spine arises from 0.33 of the carapace length, and the distally unarmed first segment of the antennular peduncle. In the latter three species, the rostrum is armed with one or two spines on the dorsal margin and one spine on the ventral margin; the carapace bears only one small median spine arising slightly posterior to the level of the orbital margin; the first segment of the antennular peduncle

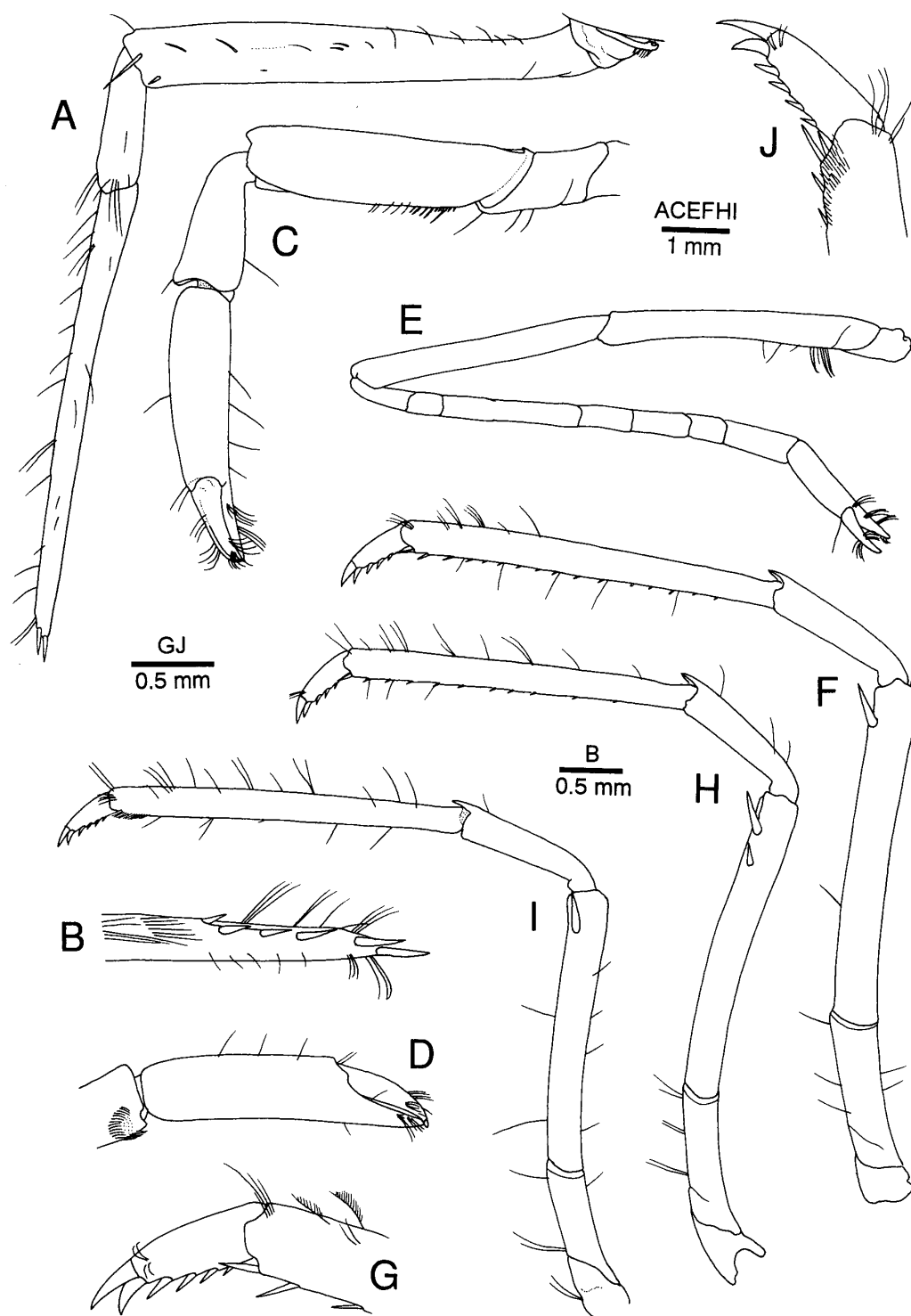


Fig. 3. *Lebbeus nudirostris* sp. nov., left appendages of holotype female (CL 6.3 mm; NSMT-Cr S004). A, third maxilliped, lateral view; B, same, distal part of ultimate segment, mesial view; C, first pereopod, lateral view; D, same, chela, ventral view; E, second pereopod, lateral view; F, third pereopod, lateral view; G, same, dactylus and distal part of propodus, lateral view; H, fourth pereopod, lateral view; I, fifth pereopod, lateral view; J, same, dactylus and distal part of propodus, lateral view.

is armed with two (*L. saldanhae*), three (*L. profundus*) or four (*L. miyakei*) spines on the dorsodistal margin.

Within the group characterized by having epipods on the anterior three pereopods, the unarmed rostrum is also found in *L. lagunae* (Schmitt, 1921) from California and Baja California and *L. catalepsis* Jensen, 1987 from Juan de Fuca, Washington State, U.S.A., but the rostrum of the latter two species is greatly reduced to a small spine (Schmitt, 1921; Jensen, 1987).

Well-developed, but unarmed rostrum is also known for *L. laevirostris* Crosnier, 1999 from Indonesia. This species is immediately distinguished from *L. nudirostris* by the absence of epipod on the third pereopod, the rostrum overreaching the distal margin of the first segment of antennular peduncle and the fourth abdominal pleuron bearing small posteroventral tooth.

The holotype female is non-ovigerous. However, the setose pleopods and remnants of egg shells still carried on the abdomen indicate that the specimen is an adult.

***Lebbeus spongiaris* Komai, 2001**

(Fig. 4A)

Lebbeus spongiaris Komai, 2001: 57, figs. 1–4.

Material examined. Southwest of Jogashima Islet, Miura Peninsula, TRV *Shin'yo-Maru*, 2002 cruise: stn. 6 (35°05.62'N, 139°32.29'E, 698–448 m), 22 October 2002, dredge, 1 female (CL 4.5 mm) (NSMT-Cr S332); South of Izu-Oshima Island, stn. 29 (34°40.21'N, 139°18.62'E, 307–289 m), dredge, 24 October 2002, 1 male (CL 3.1 mm) (NSMT-Cr S333); stn. 30, similar locality, 34°40.65'N, 139°19.29'E, 252–228 m, dredge, 24 October 2002, 1 male (CL 2.9 mm), 1 female (CL 4.5 mm) (NSMT-Cr S334).

Diagnosis. Rostrum short, not reaching distal margin of first segment of antennular peduncle; dorsal margin armed with 3 spines, including 1 spine on rostrum proper and 2 spines on carapace, posteriormost spine arising from about 0.3 of carapace length; ventral margin unarmed or

armed with 1 small subterminal tooth. Carapace with relatively strong supraorbital spine accompanied by deep U-shaped notch below it; suborbital lobe well-developed; antennal spine moderately large; pterygostomian spine small; anterolateral margin between antennal spine and pterygostomian spine with rounded notch just inferior to antennal spine and remainder nearly straight. Anterior 3 abdominal pleura broadly rounded, fourth pleuron with small posteroventral tooth; transverse groove on second abdominal tergum shallow, not abruptly delimited; telson with 2 pairs of dorsolateral spines. Eye without ocellus. First segment of antennular peduncle with 3 long teeth on dorsodistal margin; stylocerite slightly falling short of, or slightly overreaching distal margin of first segment. Antennal scale with distolateral tooth reaching rounded distal margin of blade. Third maxilliped overreaching antennal scale by 0.2–0.3 length of ultimate segment. Epipods on anterior 3 pereopods. First pereopod not overreaching antennal scale, with dactylus about 0.6 of palm length. Third pereopod moderately long and slender; dactylus moderately stout (2.8–3.0 times as long as deep), less than 0.2 of protopod length, with 5 accessory spinules; carpus unarmed; merus armed with more than 2 lateral spines. Color in life generally light pink, without conspicuous markings on body and appendages.

Distribution. Sagami-Nada Sea and Izu Islands; 228–698 m.

Remarks. The newly obtained specimens agree well with the type description except for the rostrum armed with one small subterminal spine on the ventral margin in two of the four specimens (Fig. 4A). On the other hand, it was confirmed that the shape of the anterolateral margin of the carapace between antennal and pterygostomian spines and the numbers of spines on the telson and on the dorsodistal margin of the first segment of antennular peduncle are constant. We provide here somewhat expanded diagnosis incorporating new information on the characters mentioned under the account of *L. tosaensis*.

Komai (2001) compared *L. spongiaris* with *L.*

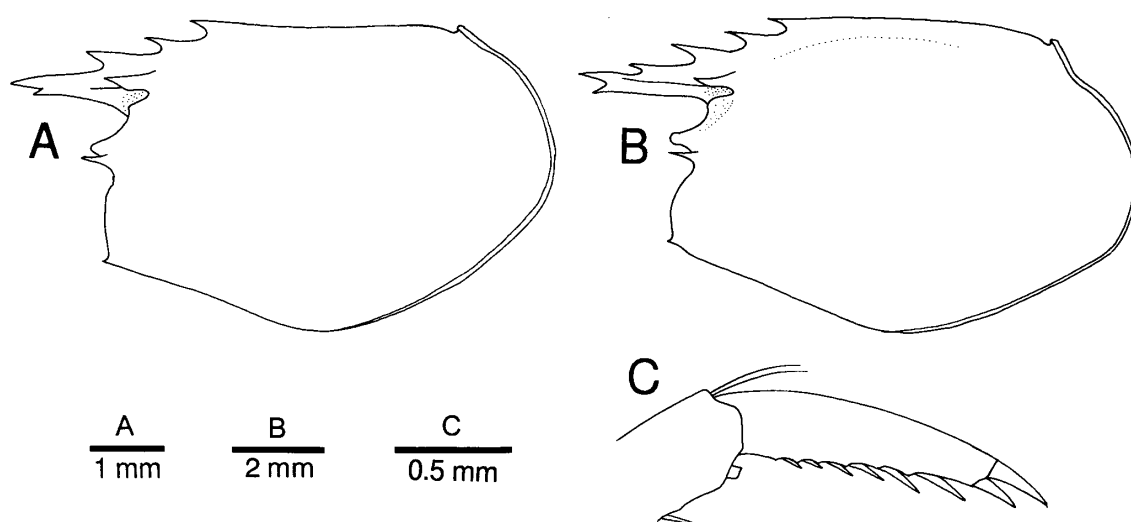


Fig. 4. A, *Lebbeus spongiaris* Komai, female from Sagami-Nada Sea (NSMT-Cr S332), carapace, lateral view. B, C, *Lebbeus tosaensis* Hanamura et Abe, female from Sagami-Nada Sea (NSMT-Cr S335). B, carapace, lateral view; C, dactylus of right third pereopod, lateral view.

microceras (Krøyer, 1841), *L. carinatus* Zarenkov, 1976 and *L. comanthi* Hayashi et Okuno, 1997, and discussed that the ventrally unarmed rostrum was diagnostic in distinguishing *L. spongiaris* from the close relatives. However, it has been found that the rostrum of *L. spongiaris* occasionally has one small subterminal tooth on the ventral margin. Nevertheless, *L. spongiaris* can be distinguished from the relatives by having only two pairs of dorsolateral spines on the telson.

Komai (2001) suggested a possible association between this species and sponge. The present specimens were collected also from sponge rich bottom, although there was no indication of close association.

***Lebbeus tosaensis* Hanamura et Abe, 2003**

(Figs. 1B, 4B, C)

Lebbeus tosaensis Hanamura & Abe, 2003: 17, figs. 1–5.

Material examined. West of Taibusa-misaki, Boso Peninsula, 35°04.68'N, 139°45.32'E, 250 m, FB *Ido-Inkyo-Maru* No. 3, trap for scampi, 1 female (CL 8.7 mm), (NSMT-Cr S335), infested by an unidentified rhizocephalan, 8 March 2002, coll. H. Namikawa & Y. Imahara,

Diagnosis. Rostrum (Fig. 4B) short, not reaching distal margin of first segment of antennular

peduncle; dorsal margin armed with 3 or 4 moderately large spines, including 1 or 2 spines on rostrum proper and 1 or 2 spines on carapace, posteriormost spine arising at 0.20–0.25 of carapace length; ventral margin usually with 1 or 2 small subterminal spines. Carapace (Figs. 1B, 4B) with relatively strong supraorbital spine accompanied by deep U-shaped notch below it; suborbital lobe well-developed; antennal spine moderately large; pterygostomian spine small, occasionally absent; anterolateral margin between antennal and pterygostomian spines somewhat to strongly sinuous. Anterior 3 abdominal pleura broadly rounded, fourth pleuron with small posteroventral tooth; transverse groove on second abdominal tergum shallow, not abruptly delimited; telson with 4 or 5 dorsolateral spines on each side. Eye without ocellus. First segment of antennular peduncle with 3 or 4 long teeth on dorsodistal margin; stylocerite reaching or slightly falling short of distal margin of first segment. Antennal scale with distolateral tooth reaching as far as rounded distal margin of blade. Third maxilliped overreaching antennal scale by 0.2–0.3 length of ultimate segment. Epipods on anterior 3 pereopods. First pereopod not reaching distal margin of antennal scale, with dactylus about 0.6 of palm length. Third pereopod long and slender; dactylus (Fig. 4C) slender (4.4–5.5 times longer

than deep), more than 0.2 of propod length, with 5–7 accessory spinules; carpus unarmed; merus armed with more than 2 lateral spines.

Coloration. As in Fig. 1B. Carapace with 3 or 4 transverse vermilion bands; 1 similar band on each first to fifth abdominal somite; meri of third to fifth pereopods banded with white and vermilion, carpi to dactyli colorless.

Distribution. Known from Tosa Bay and Sagami-Nada Sea, Pacific coast of Japan; 250–344 m.

Remarks. *Lebbeus tosaensis* is recently described by Hanamura and Abe (2003) based on four specimens from Tosa Bay at a depth of 344 m. The present specimen from the Sagami-Nada Sea agrees well with the original description except for having four spines on the dorsal rostral series (Fig. 4B), rather than three spines in the type specimens. This difference could be within the range of variation of this species. Although the original description is fully detailed, we give here somewhat expanded diagnosis of this species, adding characters not mentioned in the original description, such as the shape of the notch beneath the supraorbital spine, position of the posteriormost median spine on the carapace, shape of the anterolateral margin between antennal and pterygostomial spines, development of the transverse groove on the tergum of the second abdominal somite, and shape of the dactylus of the third pereopod (as representative of the ambulatory legs). These characters are useful in discriminating species of *Lebbeus* (personal observation).

Hanamura and Abe (2003) compared *L. tosaensis* with *L. carinatus* Zarenkov, 1976, *L. comanthi*, *L. spongiaris* and *L. washingtonianus* (Rathbun, 1902). Although they did not mention the shape of the dactyli of the third to fifth pereopods precisely, this character is useful for species discrimination in *Lebbeus*. The dactyli are distinctly more slender in *L. tosaensis* than in *L. comanthi* and *L. spongiaris* (length/height ratio 2.8–3.0 versus 4.3–5.3). As Hanamura and Abe (2003) discussed, *L. tosaensis* appears different from *L. carinatus* and *L. washingtonianus* in the rostral armature.

Acknowledgments

We thank the Nagai Fishermen's Cooperative Association for kind arrangements for carrying out the survey and the staff of the FB *Ido-Inkyo-Maru No. 3* for generous help in the field. We also thank the Misaki Marine Biological Station, the University of Tokyo, for providing us the laboratory facility. We are indebted to Drs. A. J. Bruce of the Queensland Museum and K.-I. Hayashi of the National University of Fisheries, Shimonoseki, for reviewing the manuscript.

Literature

- Barnard, K. H., 1947. Descriptions of new species of South African decapod Crustacea, with notes on synonymy and new records. *Ann. Mag. Nat. Hist.* (11), **13**: 361–392.
- Chace, F. A., Jr., 1997. The caridean shrimps (Crustacea: Decapoda) of the "Albatross" Philippine Expedition, 1907–1910, Part 7: Families Atyidae, Eugonatonotidae, Rhynchocinetidae, Bathypalaemonellidae, Processidae, and Hippolytidae. *Smith. Contr. Zool.*, (587): 1–106.
- Crosnier, A., 1999. Une nouvelle espèce de *Lebbeus* d'Indonésie (Crustacea, Decapoda, Caridea, Hippolytidae). *Zoosystema*, **21**: 453–460.
- Desbruyères, D. & M. Segonzac, 1997. *Handbook of Deep-Sea Hydrothermal Vent Fauna*. Éditions IFREMER, Brest. 280 pp.
- Fransen, C. H. J. M., 1997. *Lebbeus africanus* spec. nov., a new shrimp (Crustacea, Decapoda, Caridea, Hippolytidae) from Mauritanian waters, with redescrptions of four other species in the genus. *Zool. Meded.*, **71**: 231–260.
- Hanamura, Y. & Y. Abe, 2003. *Lebbeus tosaensis*, a new hippolytid shrimp (Decapoda, Caridea, Hippolytidae) from southwestern Japan. *Biogeography*, **5**: 17–24.
- Hayashi, K.-I., 1992. Studies on the hippolytid shrimps from Japan—VIII. The genus *Lebbeus* White. *J. Shimonoseki Univ. Fish.*, **40**: 107–138.
- Hayashi, K.-I. & J. Okuno, 1997. Two associated hippolytids, *Lebbeus comanthi* sp. nov. and *Lebbeus balssi* Hayashi (Decapoda, Caridea, Hippolytidae) from Japan. *J. Natn. Fish. Univ.*, **46**: 47–56.
- Jensen, G. C., 1987. A new species of the genus *Lebbeus* (Caridea: Hippolytidae) from the northeastern Pacific. *Bull. S. Calif. Acad. Sci.*, **86**: 89–94.
- Kikuchi, T. & S. Ohta, 1995. Two caridean shrimps of the families Bresiliidae and Hippolytidae from a hydrothermal field on the Iheya Ridge, off the Ryukyu Islands, Japan. *J. Crust. Biol.*, **15**: 771–785.

- Komai, T., 2001. *Lebbeus spongiaris*, a new species of deep-water shrimp (Crustacea: Decapoda: Caridea: Hippolytidae) from Izu Islands, Japan. *Nat. Hist. Res.*, **6**: 57–65.
- Krøyer, H., 1841. Udsigt over de nordiske Arter af Slaegten *Hippolyte*. *Nat. Tidsskr.*, **3**: 570–579.
- Rathbun, M. J., 1902. Descriptions of new decapod crustaceans from the west coast of North America. *Proc. U.S. Natn. Mus.*, **24**: 885–905.
- Rathbun, M. J., 1906. The Brachyura and Macrura of the Hawaiian Islands. *Bull. U. S. Fish. Comm.*, **23**: 827–930, pls. 3–24.
- Schmitt, W. L., 1921. The marine decapod Crustacea of California with special reference to the decapod Crustacea collected by the United States Bureau of Fisheries Steamer “Albatross” in connection with the biological survey of San Francisco Bay during the years 1912–1913. *Univ. Calif. Publ. Zool.*, **23**: 1–359, pls. 1–50.
- White, A., 1847. *List of the Specimens of Crustacea in the Collection of the British Museum*. British Museum, London. viii+141 pp.
- Zarenkov, N. A., 1976. On the fauna of decapods of the waters adjacent to South America. *Biol. Mor.*, **5**: 8–18. (In Russian.)